

Entrance Channel Design Tool

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PROJECT DESCRIPTION:

Problem Statement: The US Army Corps of Engineers designs the entrance channels for the nation's ports and harbors. One of the critical design considerations for these channels is the under keel clearance (UKC). The Corps of Engineers requires a method for determining the minimum UKC for any vessel type that is transiting in a confined navigation channel of given depth and width under existing meteorological and oceanographic conditions during the vessel transit, or for certain hypothetical conditions for economic assessment.

Objective: The objective of this work is to provide a methodology to determine the minimum value of UKC of any vessel transiting a channel configured to certain specifications. The Environmental Monitoring and Operator Guidance System (EMOGS) was developed by the Carderock Division, Naval Surface Warfare Center to predict the UKC of specific ships transiting a specific channel. To meet the objective of this work, EMOGS will be modified so that any vessel type can be entered as well as channel configurations of various widths and depths.

Impact/Payoff: The result of this project will provide the Corps of Engineers with a channel design tool so that they can assess the minimum UKC for any vessel for channels of varying widths, depths, and lengths. The minimum UKC result can then be used in the determination of vessel safety, risk assessment, dredging etc.

PROGRESS TO DATE: This project has recently gotten underway. It is planned that a shallow water ship motion program, SCORESII, will be bundled with a modified version of EMOGS so that the Response Amplitude Operators (RAOs) of any surface vessel can be generated and the UKC be calculated for a variety of channel configurations and wave/water level conditions. Additionally, a number of military and commercial cargo ships will be run through SCORES II Shallow Water Version to generate the requisite RAOs.

FUTURE PLANS: The Corps of Engineers has obtained two sets of field data for ships that transit entrance channels to Barbers Point, Hawaii, and Charleston, South Carolina, harbors. These data were collected with shipboard installed DGPS radars on vessels during their inbound and outbound transits. Water levels, currents and waves were measured along ship channels to correlate the measured ship motions to the environmental forcing. Laboratory studies are now in progress at the Waterways Experiment Station aimed at replicating these field measurements, and for testing other vessel types. This expanded database will be used for evaluation/calibration of the numerical models, including modeling capabilities of this effort, which will be extensively tested and validated with available field and laboratory data. The UKC numerical prediction capability will be incorporated into WES' Ship Simulator in the future.

PRODUCTS: The final product from this project will be a tool the US Army Corps of Engineers can use to aid them in their channel design. The channel design will be based on the minimum under keel clearance specific ship would have for a variety of oceanographic and meteorological conditions.